United States Patent [19]

Mori et al.

[11] **3,962,786**

[45] **June 15, 1976**

[54] **APPARATUS FOR CUTTING RIVETS OF TENSIONED REINFORCEMENT IN THE PROCESS OF MANUFACTURING CONCRETE PRODUCTS**

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[73] Assignee: **Nippon Concrete Industries Co. Ltd.,** Tokyo, Japan

[22] Filed: **Dec. 30, 1974**

[21] Appl. No.: **537,369**

[52] **U.S. Cl.** ..... **30/168;** 30/106; 29/200 D; 140/107

[51] **Int. Cl.²** **B26B 7/00**

[58] **Field of Search** ..... 140/107; 30/106, 124, 30/105, 107, 296 R, 179, 180, 168; 29/200 D, 426

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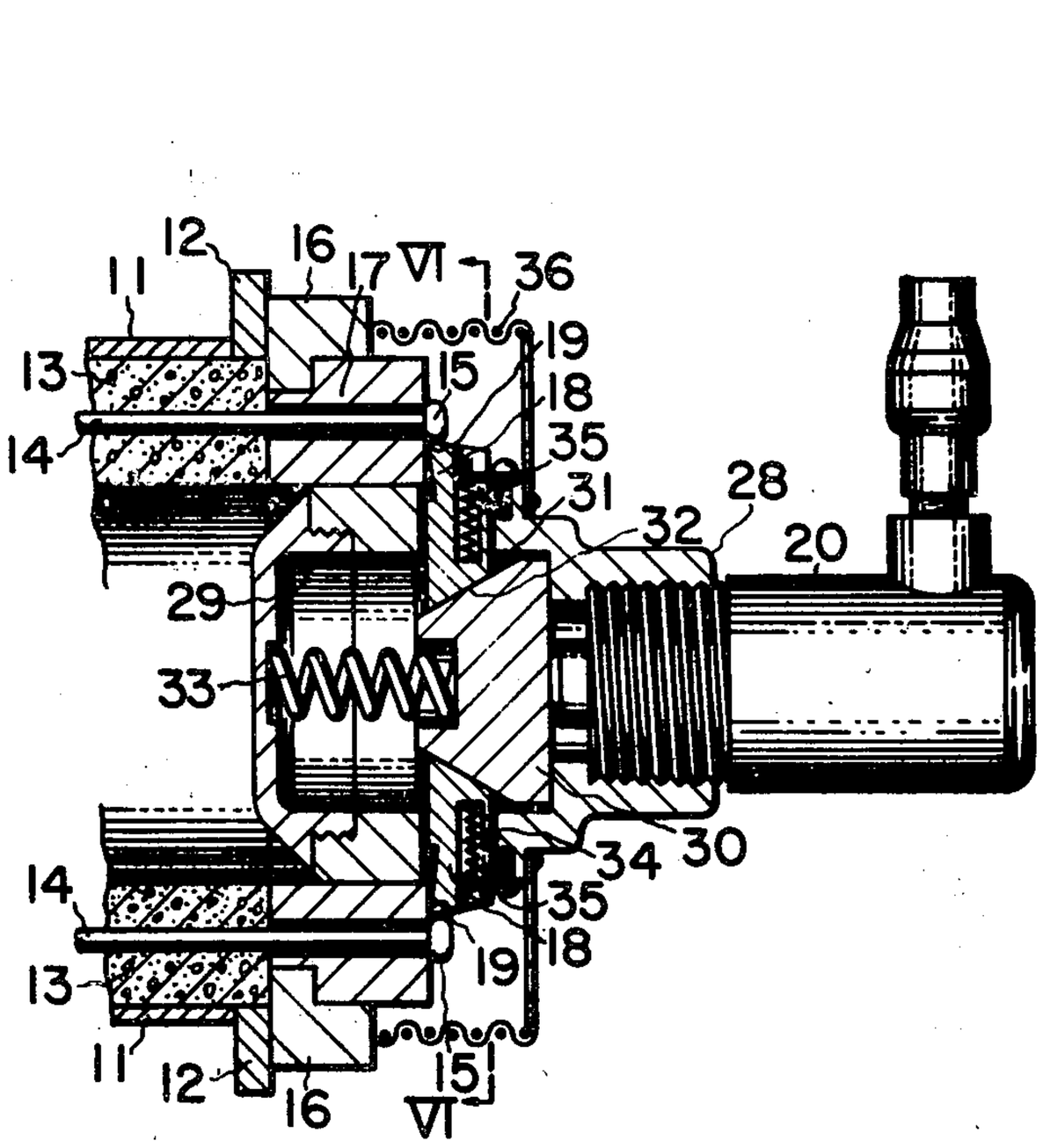
Assistant Examiner—J. C. Peters
Attorney, Agent, or Firm—Oblon, Fisher, Spivak, McClelland & Maier

[57] **ABSTRACT**

This invention relates to an apparatus for cutting away rivets of tensioned reinforcements which are protruding beyond the surface of a tension plate used for tensioning the reinforcements in order to increase the strength of a concrete product, characterized in that a chisel, for cutting rivets formed at the end of the tensioned reinforcements, is provided in such a manner that it can slide along the normal line of the tension plate and in contact with the surface of the tension plate, the chisel being interlocked with a fluid-pressure sliding mechanism, and further an immovable part of the mechanism is engaged with a part of the tension plate so that the counter force against the cutting by the chisel is obtained from the tension plate.

3 Claims, 6 Drawing Figures



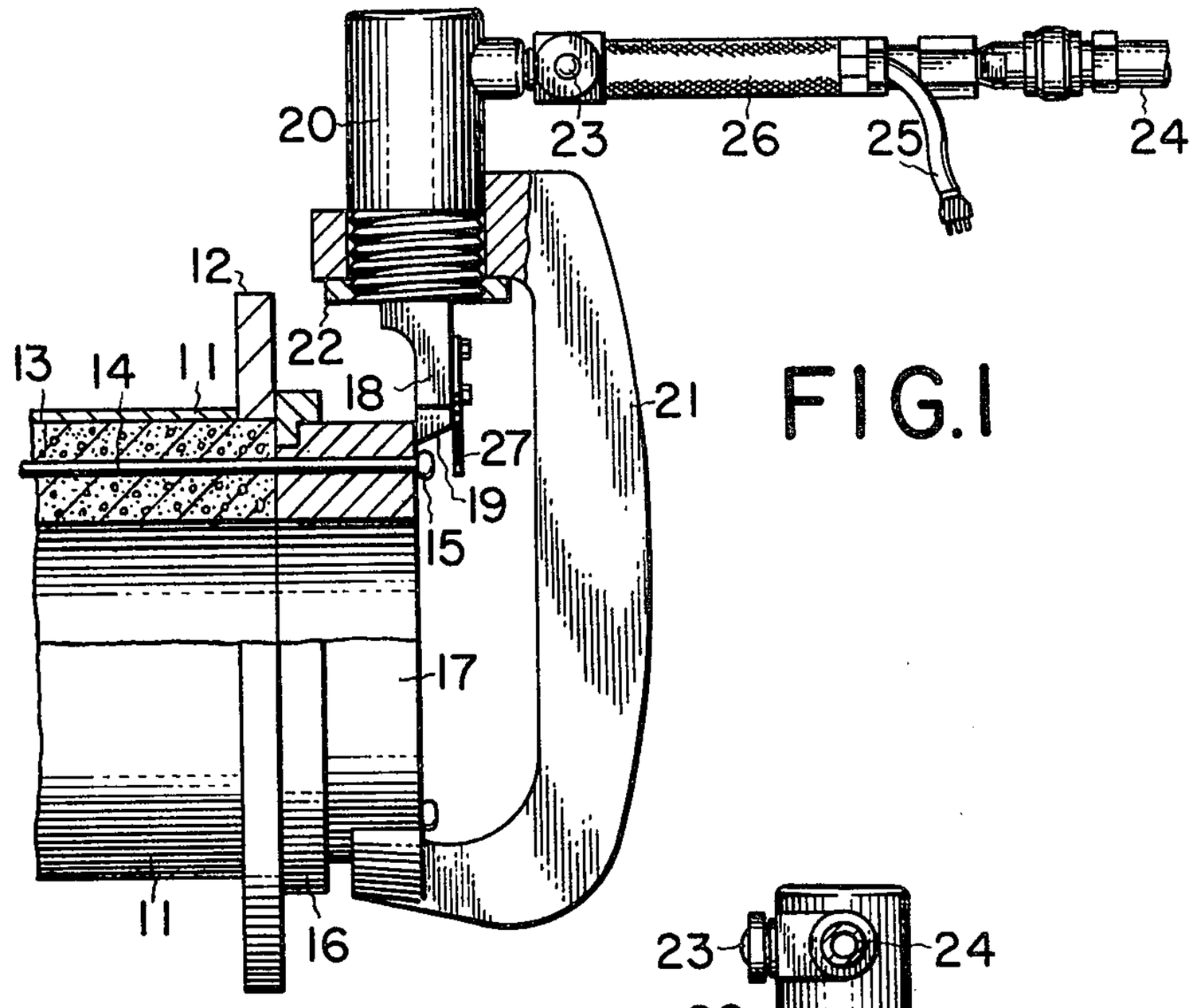

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FIG.1

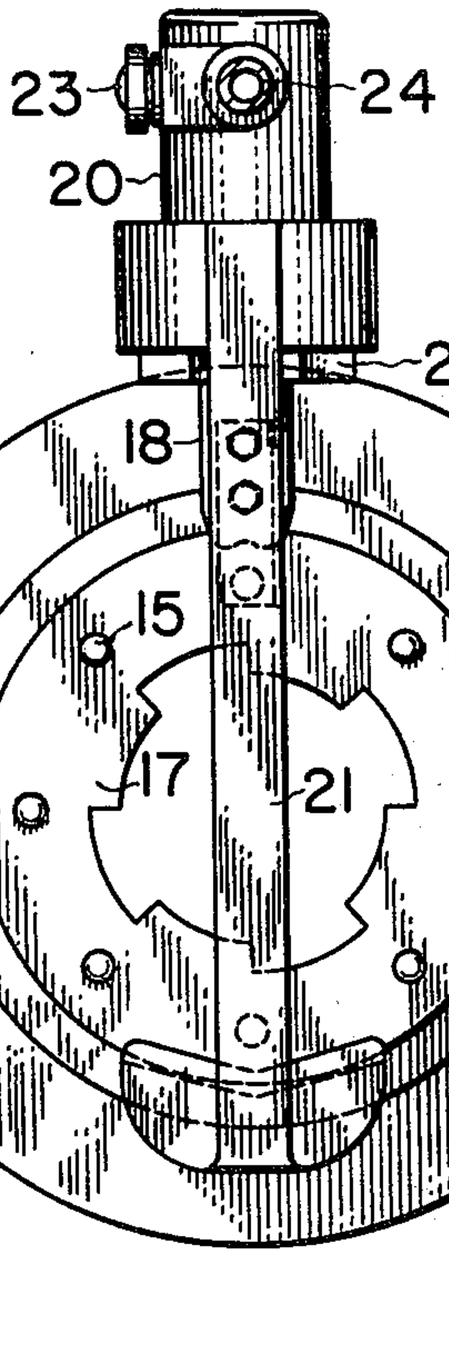
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FIG.2

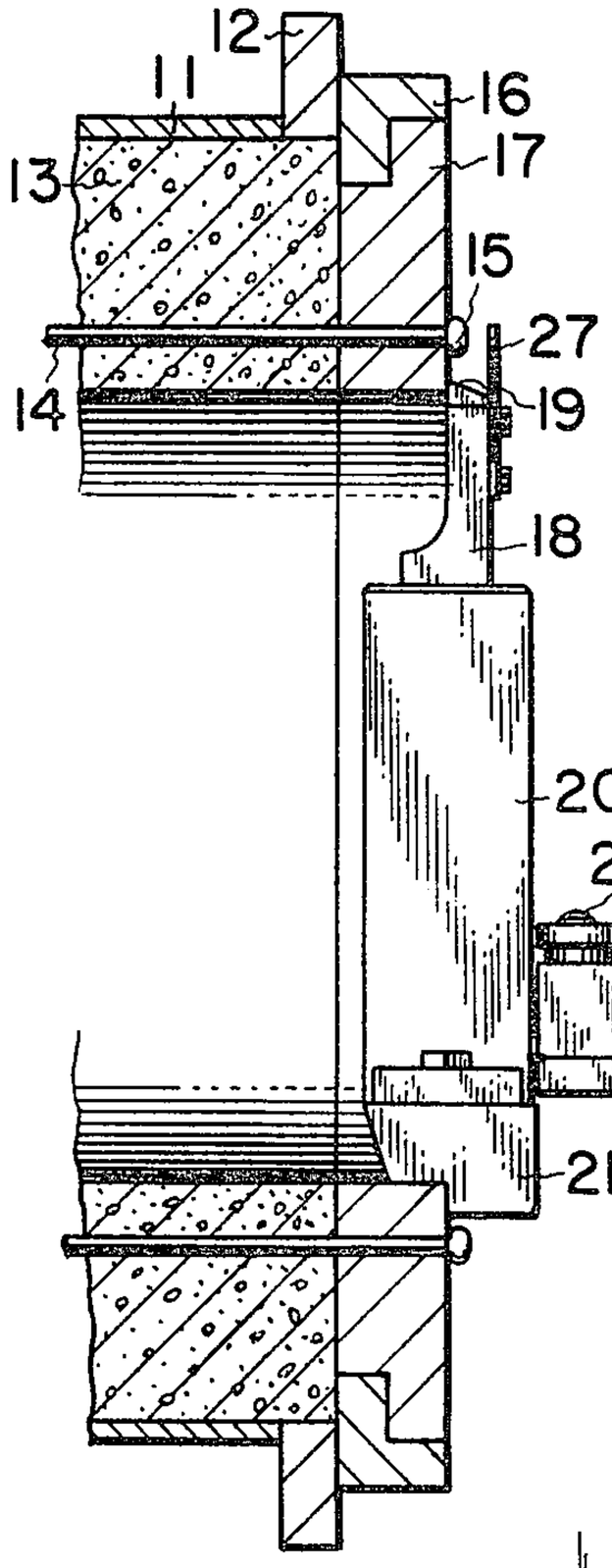
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FIG. 3

FIG. 4

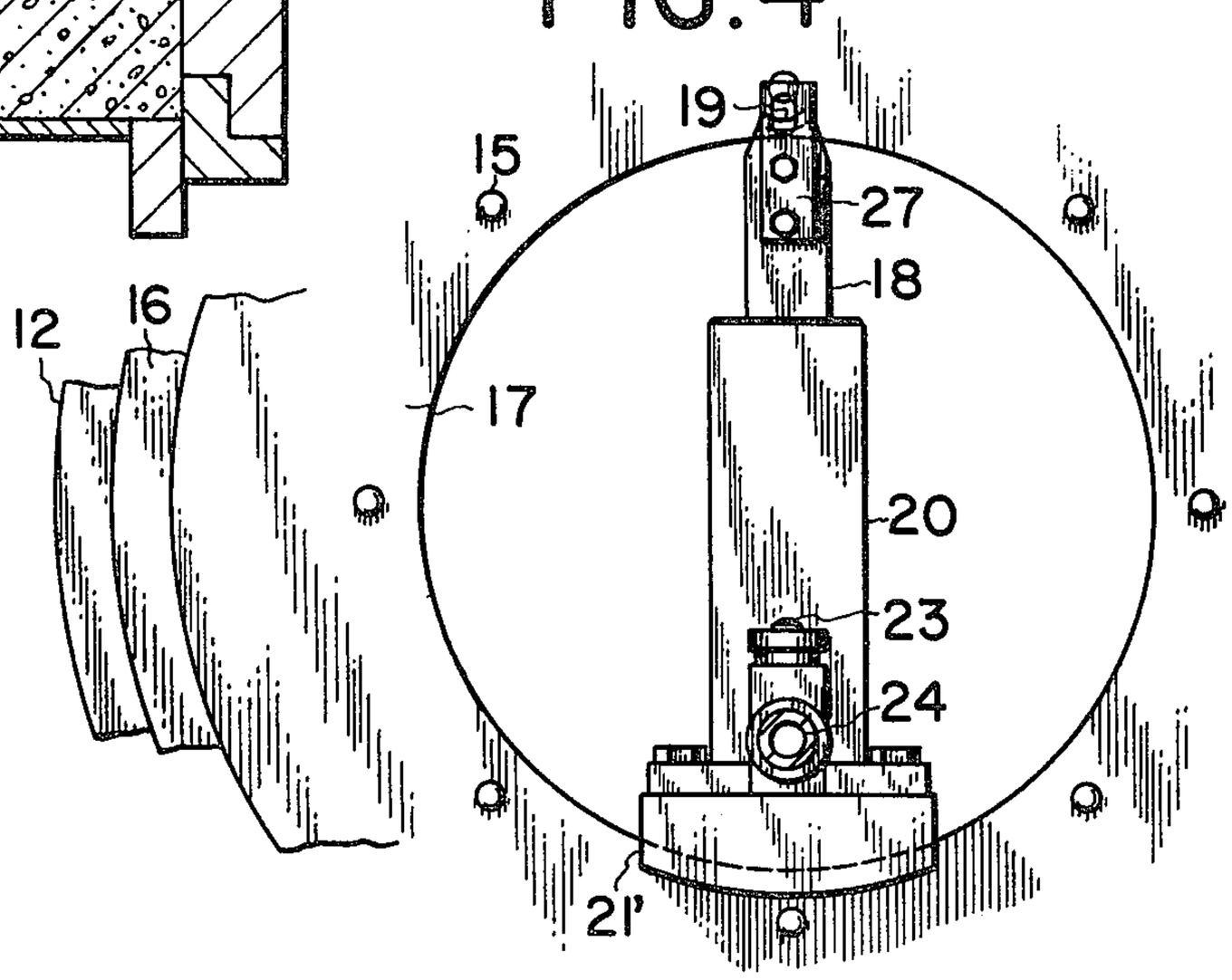
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FIG.5

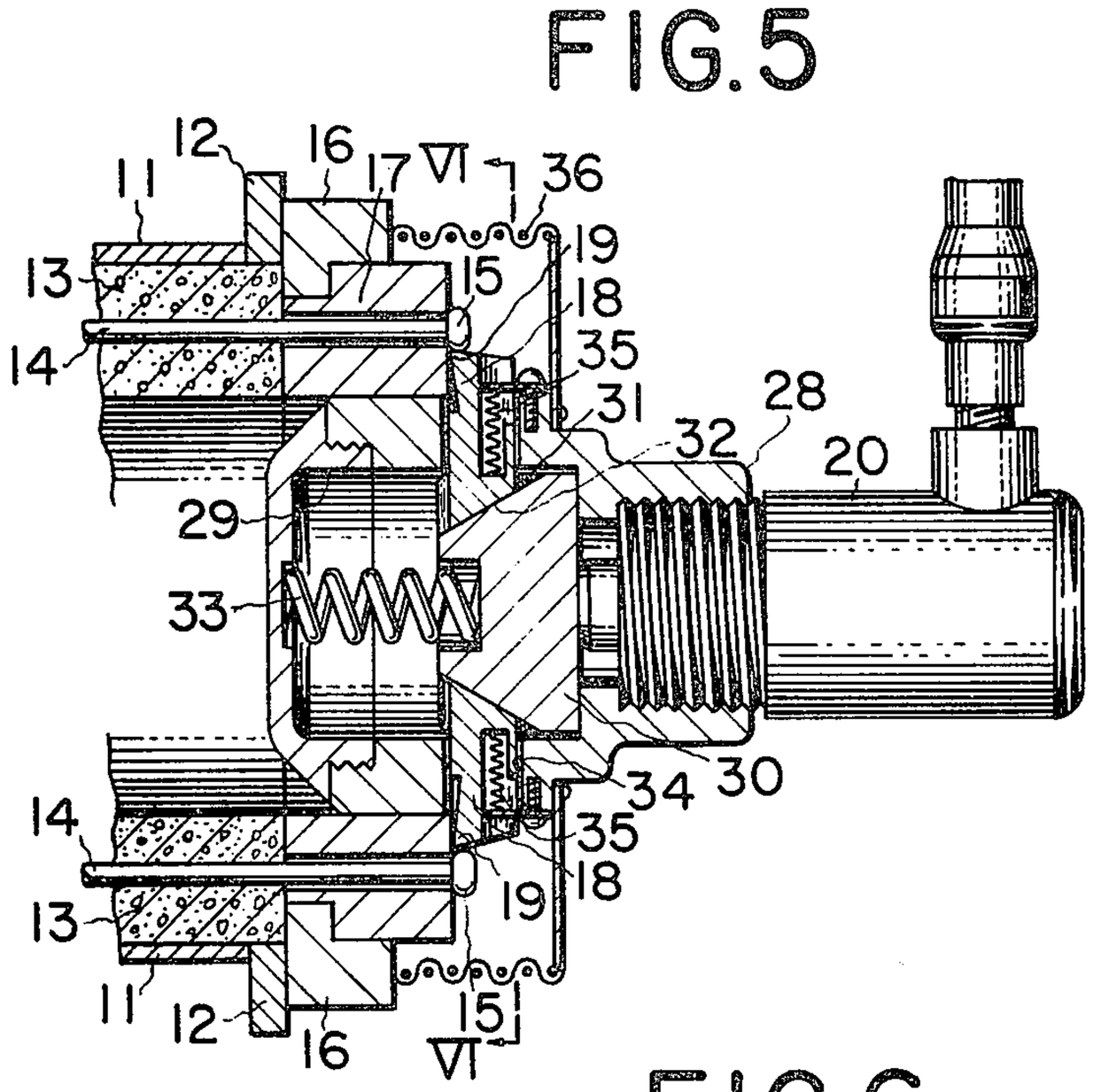
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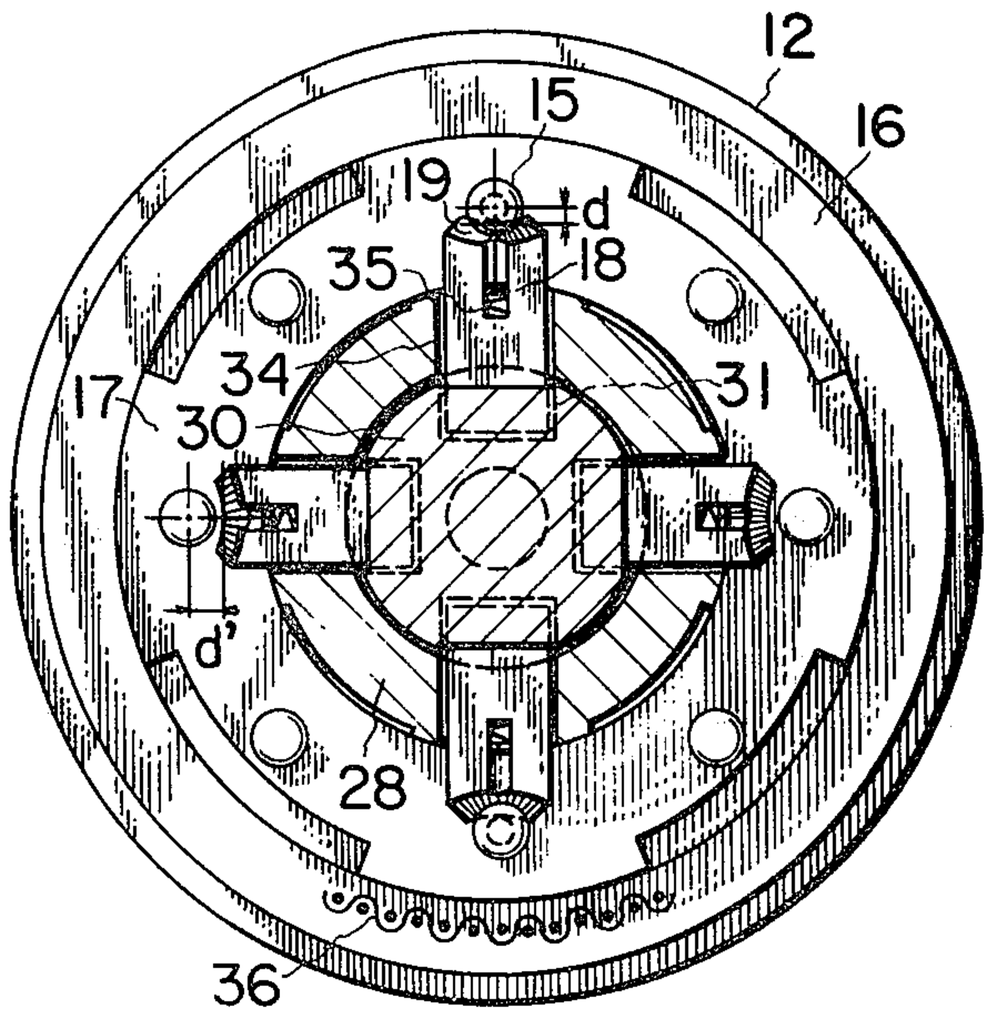
FIG.6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APPARATUS FOR CUTTING RIVETS OF TENSIONED REINFORCEMENT IN THE PROCESS OF MANUFACTURING CONCRETE PRODUCTS

BACKGROUND OF THE INVENTION

This invention relates to an apparatus for cutting away rivets of tensioned reinforcements in the process of manufacturing concrete products of poles, piles and the like.

Generally the strength of a concrete product is increased by imparting tension to the reinforcements inside the concrete product. The tension is provided by making a rivet at the end of each reinforcement, supporting the rivet on the surface of a tension plate and pulling the plate.

Therefore, after the concrete product is finished, the rivet should be cut away in order to remove the plate from the tensioned reinforcements.

Hitherto, rivets have been cut away by fusing with a flame or by hammering a chisel in contact with the rivet, so that there have been many problems such that the working efficiency is low, the cost of equipment is high, skilled technique is required, and the cut rivets sometimes scatter.

Summary of the Invention

The object of the invention is to provide an apparatus by which the above problems can be solved. The feature of the invention is that a chisel, receiving fluid pressure, is used to cut the rivets and the apparatus is small in size, light in weight, low in cost and easy to operate.

Other objects and features of the present invention will be apparent from the following detailed description of the invention.

Brief Description of the Drawings

The accompanying drawings show three examples embodying the present invention;

FIGS. **1** and **2** are respectively a side elevation view and a front elevation view of the first embodiment;

FIGS. **3** and **4** are respectively a side elevation view and a front elevation view of the second embodiment;

FIG. **5** is a side sectional view of the third embodiment; and

FIG. **6** is a sectional view taken along the line VI—VI of FIG. **5.**

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

The examples embodying the present invention will be described hereinafter according to the accompanying drawings.

In FIGS. **1** and **2,** showing the apparatus of the first embodiment of the present invention, reference numeral **11** designates a mold. An end plate **12** is attached to the end surface of the mold **11** and a concrete pole **13** is disposed inside the mold **11. 14** designates reinforcements disposed inside the concrete pole **13** and rivets **15** are formed respectively at the end of each reinforcement in order to fix the reinforcements at the time of imparting tension to the reinforcements. **17** designates a tension plate attached to the end plate **12** by a setting ring **16.** The rivets **15** of the tensioned reinforcements **14** protrude beyond the surface of the plate **17.**

18 designates a chisel for cutting the rivets **15** protruding beyond the surface of the tension plate **17** and the chisel **18** has an edge **19** at the forward end to effectively cut the rivets **15.** The chisel **18** can be freely adhered closely to the surface of the tension plate **17** and is also freely slidable in the direction of the normal line of the tension plate.

20 designates a fluid pressure mechanism (oil pressure jack) and the forward end of a sliding rod of the oil pressure jack is connected with the base of the chisel **18.** Therefore the chisel **18** is driven by the oil pressure jack **20** to cut the rivets **15.**

21 designates a counter-force receiving member which is a medium for obtaining the counter force from the tension plate which is required at the time of cutting the rivets **15** by the chisel **18.** The member **21** is fixed to the frame of the jack **20** as one body by a lock nut **22.** In this embodiment, the counter-force receiving member **21** is longer than the diameter of the tension plate **17** and the forward end of the member **21** engages a part of the outer periphery of the tension plate **17.**

23 designates a switch for opening and closing a high-pressure hose **24** which is an oil pressure circuit to operate the oil pressure jack **20.** The electricity required for the above operation is supplied from a power cord **25. 26** designates a grip which is used for setting the present apparatus on the surface of the tension plate, **17. 27** is a cover plate, for preventing the cut rivets from scattering, which is fixed on the surface of the chisel **18** so as to protrude beyond the forward end of the chisel **18.**

The operation for cutting away the rivets **15** by the use of the present apparatus of the above structure will be explained hereinafter.

First the high-pressure hose **24** and the power cord **25** are connected respectively with the pressure source and the power source. Subsequently, the forward end of the counter-force receiving member **21** is set on a part of the outer periphery of the tension plate **17,** and the chisel **18** is adhered closely to the surface of the tension plate **17** in such a manner the edge **19** is placed opposite to the rivet **15** from the outside. Next the switch **23** is turned on to work the jack **20.** The jack **20** slides the chisel **18** in the direction of the normal line of the tension plate **17** so that the rivet **15** is cut away. At this time, the counter force can be obtained from a part of the outer periphery of the tension plate **17** which is directly opposite to the position of the chisel **18** through the frame of the jack **20** and the counter-force receiving member **21.**

The position of the chisel **18** is adjusted for each rivet and the above operation is repeated to cut away all the rivets. Consequently, the end plate **12,** the setting ring **16** and the tension plate **17** can be freely removed.

FIGS. **3** and **4** show the apparatus of the second embodiment of the present invention. Only the method of obtaining the counter force required at the time of cutting the rivets is different from the first embodiment, and the structure and the operation are common to the first embodiment. Namely a counter-force receiving member **21′** is in contact with a part of the inner surface of the tension plate **17** which is directly opposite to the position of the chisel **18.** Consequently the chisel **18** is slid by the jack **20** outward from the center of the tension plate **17** and the jack **20** is placed within the central portion of the tension plate **17.** Accordingly, the present embodiment is suitable mainly for a large diameter concrete pole and the like.

In the above-described two embodiments, one rivet is cut at a time. However it is also possible that more than one set of the jack and the chisel is able to be provided. In that case, a counter-force receiving member should have a shape by which the counter force of each direction can be obtained.

FIGS. **5** and **6** show the third embodiment of the present invention. In the apparatus of the present embodiment, a number of rivets protruding beyond the surface of the tension plate can be cut away at a time or by one attaching operation with one jack. In the drawings, the same reference numerals as in FIGS. **1** to **4** show the same parts. **28** designates a main body to be engaged with the central part of the tension plate **17.** The outer surface of the main body **28** is in contact with the inner surface of the tension plate **17.** The counter force required at the time of cutting rivets **15** with a chisel **18** is obtained from that part. An oil-pressure jack **20** is attached to the central part of the main body **28** by a screw or the like. At the forward part of the jack **20** a guide chamber **29** is formed along the axial line of the tension plate **17.**

30 designates a piston which is provided at the forward end of a rod of the jack **20** and disposed in the guide chamber **29.** The piston **30** is pushed forward in the chamber **29** by the jack **20** at the time of cutting the rivets **15.** Around the outer periphery of the piston **30** there are formed four radial guide grooves **31** along the normal line of the piston **30** and disposed equiangularly thereabout. The bottom of each groove **31** is formed into an inclined plane **32** which is close to the axial core of the piston **30** and which is inclined toward the moving direction of the piston **30.** A spring **33** is provided between the piston **30** and the bottom of the guide chamber **29** to push back the piston **30** to the original position after the rivets **15** are cut.

The chisels **18** for cutting the rivets **15** of the tensioned reinforcements **14** are disposed respectively in a freely slidable manner in the four guide grooves **31** and four guide holes **34,** which are formed radially at equal intervals within the wall of the main body **28,** respectively, and open to a corresponding groove **31.** The rear end surface of each chisel **18** is always in contact with the inclined plane **32** of the guide groove **31** in such a manner that the chisel **18** can slide on the plane **32** by means of a spring **35,** one end of which is fixed at a part of the main body **28.** Moreover, as shown in FIG. **6,** the distances d and d' between the edge of each chisel **18** and the axial core of the rivet **15** have a determined suitable difference. Therefore, the time of cutting each rivet **15** is slightly different, so that the force required for the cutting can be decreased.

Reference numeral **36** designates a net attached to the main body **28** surrounding the outside of each chisel **18** and each rivet **15** with the object of preventing the cut rivets **15** from scattering and for collecting them.

The operation of cutting the rivets by the use of the apparatus of the above structure will be explained hereinafter.

First, the main body **28** is disposed within the central hole of the tension plate **17.** At the time of cutting the rivets **15,** the piston **30** is pushed forward by means of the jack **20,** so that the chisels **18,** which are always in contact with the inclined planes **32,** slide in the guide grooves **31** and the guide holes **34** along the inclined planes **32** and in the direction of the normal line of the tension plate **17** and cut the rivets **15** which are opposite to the edges **19.** At this time, the counter force acts on a part of the inner surface of the tension plate **17,** which is opposite to the cutting rivet, through the piston **30** and the main body **28.** Therefore, the connection of the main body **28** and the tension plate **17** is strengthened, so that there is no anxiety that the main body **28** will slip off the tension plate **17.**

In the case that the distances between each chisel **18** and each rivet **15** have a little difference, the cutting of each rivet **15** is done in order, so that the force of the jack **20** to be given to the piston **30** is always required only for cutting one rivet **15** (or two rivets in case two rivets **15** opposite to each other are cut at the same time).

After the rivets **15** opposite to each chisel **18** are cut, the force of the jack **20** imparted to the piston **30** is removed, and thereby the piston **30** is pushed back to the original position by the pressure of the spring **33.** All the while, each chisel **18** is maintained in contact with the inclined plane **32** by the spring **35.**

Each cut rivet **15** is prevented from scattering by the net **36** and is collected within the net **36.**

Thereafter, the main body **28** is turned to place each chisel **18** at a position opposite to the next cutting rivet **15** and the above operation is repeated.

As abovedescribed, according to the present invention, after a concrete product is completed, rivets of tensioned reinforcements can be automatically and rapidly cut. Therefore, labor can be reduced, and the present apparatus is extremely effective and causes no risk, as compared with the case by men, and is superior in the cost of equipment, safety and treatment, as compared with the case by gas or arc.

If the apparatus is constructed so as to be freely removable from a tension plate, it can be used easily for other things. The construction is also possible by which a number of rivets can be cut away at one operation, and thereby the efficiency can be improved. In that case, if the time of cutting by each chisel is a little different, large forces are not required for the cutting and thereby the apparatus can be made small.

We claim:

1. Apparatus for cutting rivets, formed upon the ends of tensioned reinforcements, which protrude beyond the surface of an annular tension plate used for tensioning said reinforcements in order to increase the strength of a concrete product, comprising:

a main body co-axially aligned with said tension plate and having one end thereof disposed interiorly of said tension plate, the diameter of said body being substantially the same as, or slightly less than, that of said tension plate whereby said body is in peripheral contact with the inner surface of said tension plate so as to stabilize said main body, with respect to said tension plate and said concrete product, when said apparatus cuts said rivets;

a plurality of radially extending chisel means slidably disposed, within said main body and along the outer radially disposed end surface of said tension plate for simultaneously engaging and cutting said rivets, the radially inner ends of said chisel means having inclined surfaces;

an oil pressure jack operatively connected to the other end of said main body;

a piston slidably disposed within said main body and operable by means of said oil pressure of said jack;

said piston having a substantially frusto-conical configuration so as to include a substantially conical

peripheral surface which simultaneously operatively engages said inclined surfaces of said chisel means;

axially disposed spring means interposed between said one end of said main body and said piston for biasing said piston against the oil pressure of said jack; and

radially disposed spring means interposed between said main body and said chisel means for biasing said chisel means against the inclined peripheral surface of said piston means.

2. Apparatus as set forth in claim **1**, further comprising:

flexible cover means secured to said main body and said tension plate for covering said tension plate so as to prevent scatter of said rivets after said rivets have been cut by said chisel means.

3. Apparatus as set forth in claim **1**, wherein:

said chisel means comprises four chisels equiangularly disposed about the periphery of said main body.

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